

How 1000BASE-T Works

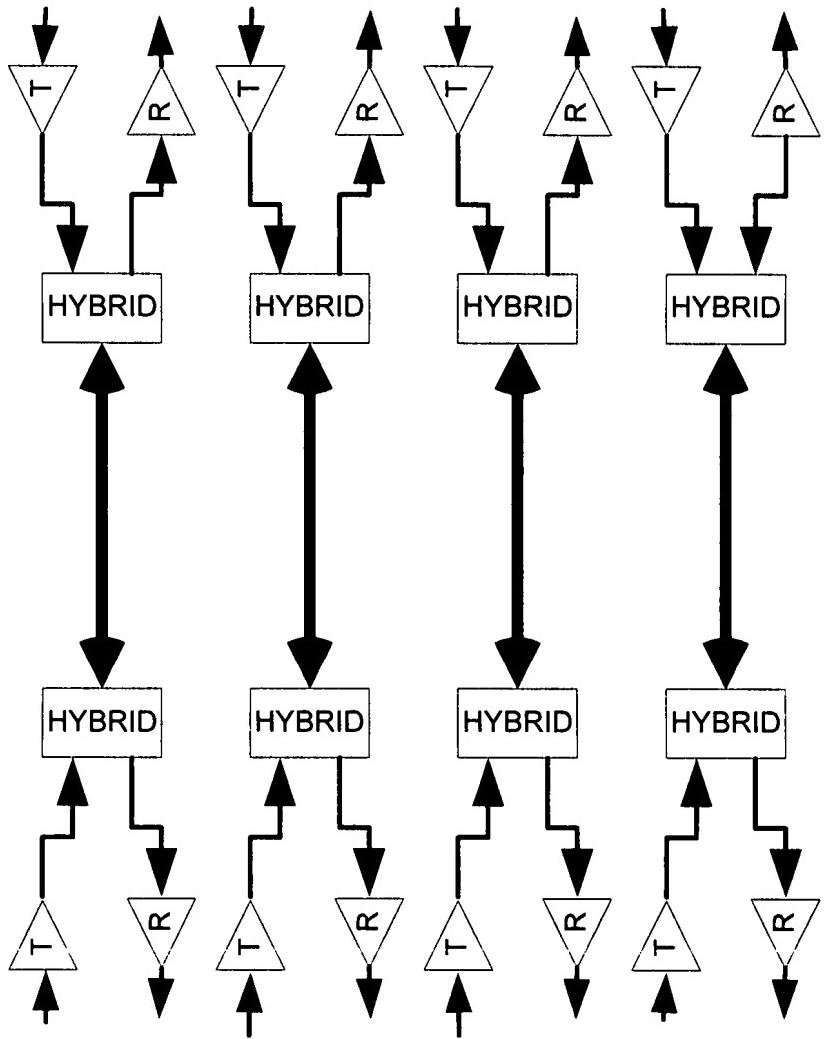
Geoff Thompson

IEEE802.3 Plenary

13 Nov 97, Montreal PQ CANADA



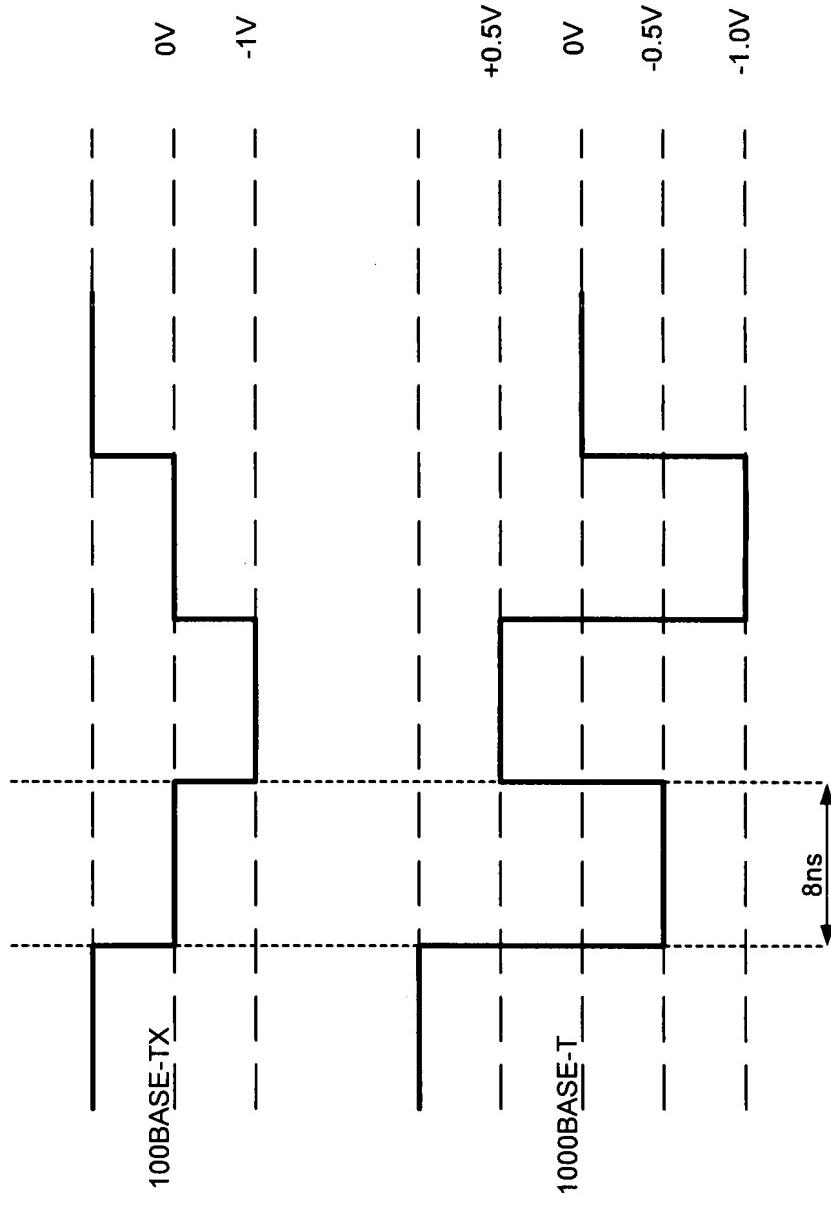
Use all four pairs with full-duplex transmission on each pair. (Requires hybrid.)



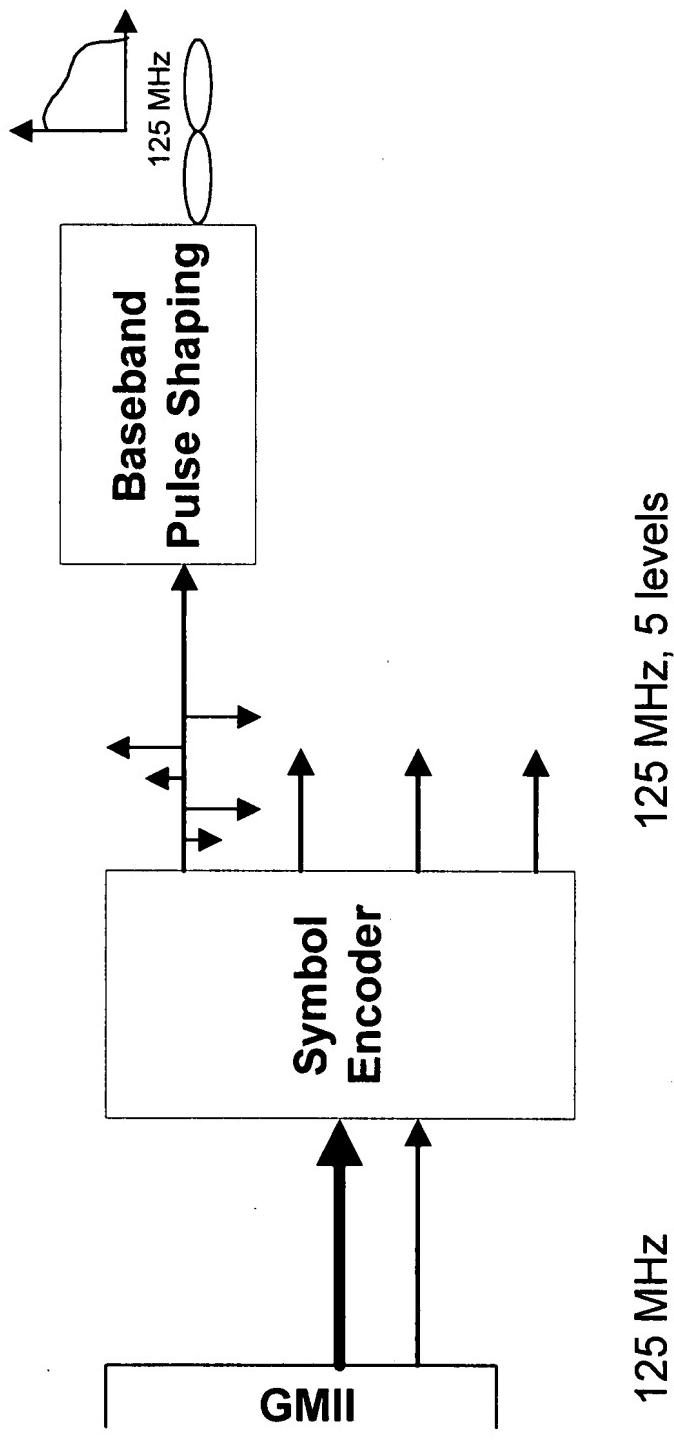
Use 5-Level Phase Amplitude Modulation (PAM)

signaling to increase the amount of information transmitted with each code point.

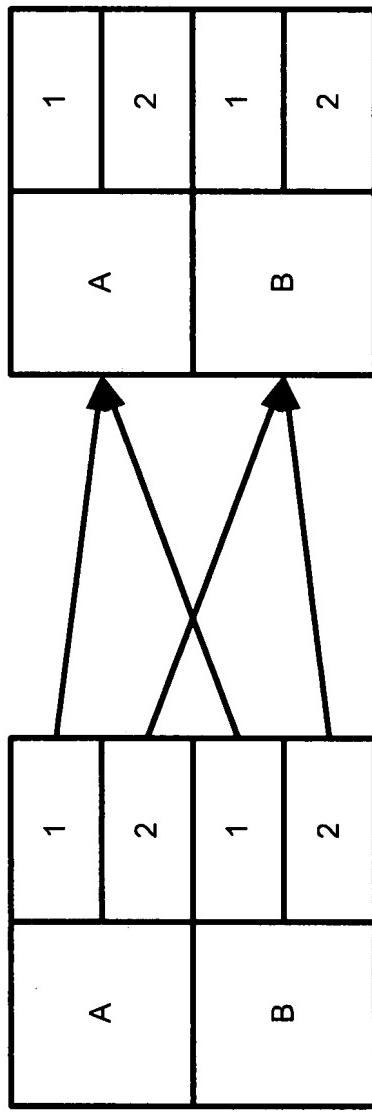
$$5 \times 5 \times 5 \times 5 = 625 \text{ code points}$$



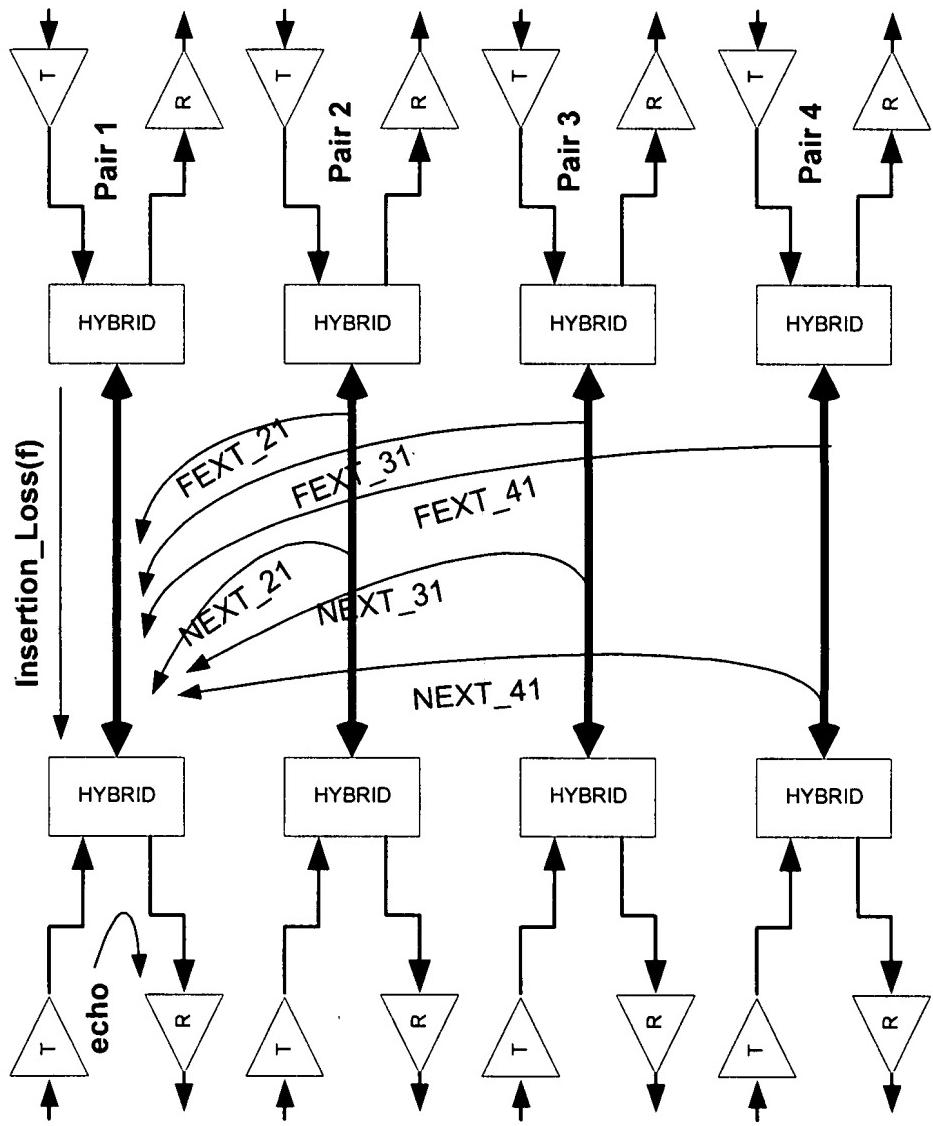
Shape the signal pulse so it conforms to the shape of
100BASE-TX



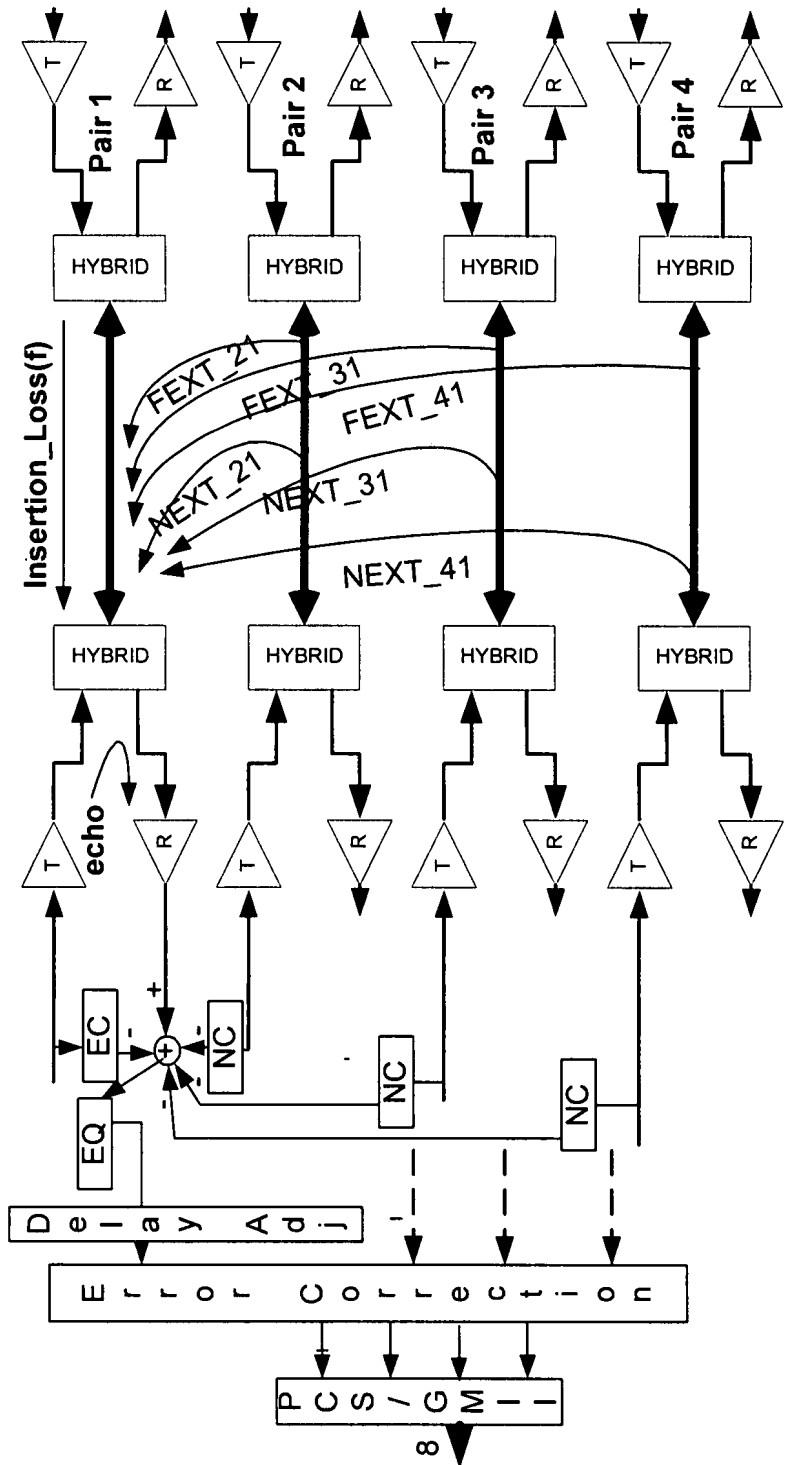
- 5-level signaling reduces noise immunity. Use Forward Error Correction to increase noise immunity.
 - 625 code points allow 2X redundancy ($256 \times 2 = 512$) with additional code points for control.
- Organize code points in subsets so that each arriving code point defines the subset membership of the next code point.



Using four pair and full-duplex on each pair introduces echo and crosstalk



1000BASE-T uses DSP-based adaptive filtering to cancel the effects of echo, crosstalk and noise



1000BASE-T

- 125 MHz clock
- Four pair
- PAM 5 coding on each pair
- One byte per BAUD over four pair
- Full-duplex on each pair